REMARKS

Claims 13-24 are pending. Claims 25-27 have been added.

Claims 13-24 stand rejected under 35 USC §112, first and second paragraphs.

Claims 13-14 stand rejected under 35 USC 102(e).

Claims 15-24 stand rejected under 35 USC §103(a).

The abstract, drawings, and specification have been amended in response to the Examiner's request for the purpose of improving the readability of the application and for the purpose of overcoming the Examiner's objections. All modifications were made at the Examiner's request. No new matter has been added.

Claims 13-24 have been amended to overcome the examiner's objection and rejection under 35 USC §112, 102(e), and 103(a) set forth in the Office Action. Claims 13-24 have been amended to further particularly point out and distinctly claim subject matter regarded as the invention. No new matter has been added.

Attached hereto is a marked-up version of the changes made to the abstract, specification, and claims by the current amendment. The attached version is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Drawings

The attached drawings FIGS. 1-17 are hereto submitted under 37 CFR 1.81. No new matter has been introduced in the required drawings.

Abstract

The abstract stands objected to because of alleged informalities. The abstract has been amended to reflect the Examiner's suggestions. No new matter has been added.

Specification

The disclosure has been amended for the purpose of improving the readability of the application and are of a clerical, typographical or grammatical nature. No new matter has been introduced.

The disclosure has been amended to replace "splitter" with "plate" throughout the detailed description section to correct a translation error.

Claim Objection

Claim 13 stands objected to because of informalities. Claim 13 has been amended to overcome the Office Action objection by changing "one f the said light beams" to "one of the said light beams". No new matter has been added.

Therefore, applicant submits that the above claims have been amended with the Examiner's suggestions and thus overcome the objections set forth in the office action.

Rejection under 35 USC §112, first paragraph – claims 13-24

Claims 13-24 stand rejected under 35 USC 112, first paragraph because the specification allegedly fails to teach the phase splitter "divide… light beam into at least two sub-beams" as recited in claim 13. This rejection is respectfully traversed.

Claim 13 has been amended to include a "phase plate" that splits the beams into sub-beams. See specification page 9, line 5 and FIG. 3. The specification has also been amended to replace "phase splitter" with "phase plate" to further clarify the subject matter. The action of a particular phase plate on a wave is supported by the specification from page 13, line 10 to page 9, line 14, and FIG. 3. The phase plate as illustrated in FIG. 3 introduces a phase shift in one of the two sub-beams due to the step (thickness change) of the plate. The phase plate is supported and described by the specification at page 10, lines 21-27.

Therefore, the specification gives support for splitting the light beam into sub-beams. Applicant respectfully requests that the 35 USC 112, first paragraph rejection be withdrawn.

Rejection under 35 USC §112, first paragraph – claim 16

Claims 13-24 stand rejected under 35 USC 112, first paragraph because the specification allegedly fails to teach how the position of the phase shift or the value of the phase shift is modified by time as recited in claim 16. This rejection is respectfully traversed.

Examples of means for adjusting the position of the phase shift or the value of the phase shift modified by time are described in the specification from page 13, line 10 to page 14, line 9. An example of a position of a phase shift modified by time is described in the specification from page 38, line 19, to page 42, line 10: in this example, the movement of a phase plate is defined by a function z(t) and this function is computed in order to obtain a particular modulation envelope for a grating, the modulation envelope

being defined by a function A(z); two cases are even considered on page 42: a linear modulation envelope and a Gaussian modulation envelope.

Therefore, the specification gives support for means for adjusting the position of the phase shift or the value of the phase shift modified by time. Applicant respectfully requests that the 35 USC 112, first paragraph rejection be withdrawn.

Rejection under 35 USC §112, second paragraph – claims 13-24

Claim 13 stands rejected under 112, second paragraph as allegedly being indefinite for failing to particularly point out and distinctly claim subject matter that the Applicant regards as the invention. This rejection is respectfully traversed.

The Office Action alleges that claim 13 is indefinite because it allegedly recites the broad recitation "forming a light guide" and also "particularly in an optical fiber." Claim 13 has been amended to remove the recitation "particularly in an optical fiber".

The Office Action alleges that claim 23 is indefinite because it allegedly recites the broad recitation "determine index modulation envelope" and also "particularly an apodized Bragg grating." Claim 23 has been amended to remove the recitation "particularly an apodized Bragg grating."

The Office Action alleges that claim 13 is indefinite because the phrase "the interference pattern… is transferred directly into the substrate" is allegedly indefinite. The process according to claim 13 uses two light beams which have the same wavelength and are coherent with each other; therefore the angular offset of these two light beams generates an interference pattern in an area of space where these two beams intercept each other; the interference pattern can be transferred to the substrate if the latter is in that

area. FIGS. 10-12 of the specification illustrates grating formed in the light guide (for example, an optical fiber) that crosses with the interference area. See specification at page 8, lines 20-26, and page 9, lines 15-21. To particularly point out and distinctly claim subject matter that the Applicant regards as the invention, claim 13 has been amended to replace "transferred" with "written".

The Office Action alleges that claim 13 is indefinite because the phrase "the Bragg network" allegedly lacks proper antecedent basis. Claim 13 has been amended to replace "the Bragg network" with "the Bragg grating".

The Office Action alleges that claims 14 and 15 allegedly fail to provide appropriate means for carrying out the functions. According to MPEP 2173.05(g), a functional limitation is an attempt to define something by what it does, rather than by what it is. There is nothing inherently wrong with defining some part of an invention in functional terms. Functional language does not, in and of itself, render a claim improper. *In re Swinehart*, 439 F. 2d 210, 169 USPQ 226 (CCPA 1971).

The Office Action alleges that the phrase "the position of the phase shift" in claim 16 and the phrase "a phase shift" in claim 17 allegedly appears to be vague and indefinite. The Applicant submits that a phase is a physical feature of a physical oscillation (an electromagnetic oscillation in the present case) and characterizes the time shift between two waves having the same frequency. This physical feature can be measured with electronic devices, such as phase meters.

Not true

Phase shift

The Office Action alleges that claims 18 and 19 are allegedly incomplete for omitting essential structural cooperative relationships of elements. Claims 18 and 19

have been amended to include structural cooperative relationships between the interferometric means and the elements recited in the apparatus of claim 17.

The Office Action alleges that the alternative phrase "a prism or a Lloyd folded mirror" in claim 19 allegedly appears to be vague and indefinite. Claim 19 has been amended to remove the "Lloyd folded mirror".

The Office Action alleges that claims 21 and 23 are narrative, functional, and confusing. Claims 21 and 23 have been amended to further particularly point out and distinctly claim subject matter that the Applicant regards as the invention.

In view of the foregoing, it is respectfully asserted that claims 13-27 are now in condition for allowance. The applicant respectfully requests the rejection to the claims under §112, second paragraph be withdrawn.

Rejection under 35 USC §102(e) – claims 13 and 14

Claims 13 and 14 stand rejected under 35 USC 102(e) as being allegedly anticipated by Kashyap (USPN: 6,307,679). This rejection is respectfully traversed.

A claim must be anticipated for a proper rejection to stand under 35 USC §§102(a), (b), and (e). This requirement is satisfied "only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference"; see MPEP 2131 and Verdegaal Bros. V. Union Oil, 814 F.2d 628, 2 USPQ2d 1051 (Fed. Cir. 1984). A rejection under 102(e) may be overcome by showing that the claims are patently distinguishable from the prior art; see MPEP §706.02(b).

The Office Action asserts that Kashyap recites all of the limitations set forth in claims 13 and 14. Kashyap teaches a method for making an apodized Bragg grating in an

optical fiber. In Kashyap, a first set of interference is formed by means of two light beams 4 and 3a from the same laser and a second set of interferences is formed by means of a beam 4 and another beam 3b. This beam 3b is obtained by placing a transparent corner 15 in beam 3a.

On the other hand, claim 13 of the present application claims:

13. A process for writing a Bragg grating in a transparent substrate, the Bragg grating forming a spectral filter with regard to a light wave that passes through it, the process comprising:

generating an interference pattern between two light beams with the same wavelength and coherent with each other but with angular offset; and

writing said interference pattern to the transparent substrate, in the form of a modulation of the refraction index of the substrate, with a phase plate having an adjustable position and orientation,

wherein said phase plate divides at least one of said light beams into at least two sub-beams, creates a phase shift between said at least two sub-beams, and generates a corresponding phase shift in the Bragg grating.

The cited reference, Kashyap, does not teach or disclose a process for writing a Bragg grating with **a phase plate** used to divide at least one light beam into at least two phase shifted sub-beams. (see claim 13). Furthermore, the phate plate has an **adjustable position and orientation**. (see claim 13).

In contrast, Kashyap teaches using a **fixed wedge** to write a Bragg grating. Col. 5, line 61. Kashyap therefore discloses a static photo-writing method whereas the presently claimed invention claims a dynamic photo-writing method.

With respect to dependent claim 14 which depend from claim 13, the arguments set forth above are equally applicable here. In addition, the Office Action admits, "with regard to claim 14, Kashyap does not teach explicitly about the interference pattern is formed according to an amplitude separation configuration". The base claims being allowable, the dependent claims must also be allowable.

The presently claimed invention is, accordingly, distinguishable over the cited reference. In view of the foregoing, it is respectfully asserted that claims 13 and 14 are now in condition for allowance.

Rejection under 35 USC §103(a) – claims 15, 21, and 23

Claims 15, 21, and 23 stand rejected under 35 USC 103(a) as being allegedly unpatentable over Kashyap (USPN: 6,307,679). This rejection is respectfully traversed.

Under MPEP §706.02(j), in order to establish a prima facie case of obviousness required for a §103 rejection, three basic criteria must be met: (1) there must be some suggestion or motivation either in the references or knowledge generally available to modify the reference or combine reference teachings (MPEP §2143.01), (2) a reasonable expectation of success (MPEP §2143.02), and (3) the prior art must teach or suggest all the claim limitations (MPEP §2143.03). See In re Royka, 490 F. 2d 981, 180 USPQ 580 (CCPA 1974).

Kashyap teaches a method for making an apodized Bragg grating in an optical fiber. In Kashyap, a first set of interference is formed by means of two light beams 4 and 3a from the same laser and a second set of interferences is formed by means of a beam 4 and another beam 3b. This beam 3b is obtained by placing a transparent corner 15 in beam 3a.

As acknowledged by the Office Action, Kashyap fails to teach explicitly that the interference pattern is formed according to a wave front separation configuration.

On the other hand, claim 13 of the present application claims:

13. A process for writing a Bragg grating in a transparent substrate, the Bragg grating forming a spectral filter with regard to a light wave that passes through it, the process comprising:

generating an interference pattern between two light beams with the same wavelength and coherent with each other but with angular offset; and

writing said interference pattern to the transparent substrate, in the form of a modulation of the refraction index of the substrate, with a phase plate having an adjustable position and orientation,

wherein said phase plate divides at least one of said light beams into at least two sub-beams, creates a phase shift between said at least two sub-beams, and generates a corresponding phase shift in the Bragg grating.

Applicant requests reconsideration of claims 15, 21, and 23 rejection for the following reason:

Even if the teachings of Kashyap were to be modified in the manner proposed, the proposed modification would not possess all of the claim limitations of claims 15, 21, and 23. The claim limitations of claims 15, 21, and 23 would still have novel and unobvious limitations over the proposed modification.

The proposed modification of Kashyap does not teach or disclose writing an interference pattern to the substrate with a phase plate having an adjustable position and orientation. (see claim 13). Thus the use of a phase plate for a dynamic photo-writing method is neither disclosed nor suggested in Kashyap as specifically claimed in claims 15, 21, and 23.

Thus, Applicant submits that claims 15, 21, and 23 recite novel subject matter which distinguishes over any possible modification of Kashyap.

The presently claimed invention is, accordingly, distinguishable over the cited reference. In view of the foregoing, it is respectfully asserted that 15, 21, and 23 are now in condition for allowance.

<u>**Rejection under 35 USC §103(a) – claims 16-18 and 20**</u>

Claims 16-18, and 20 stand rejected under 35 USC 103(a) as being allegedly unpatentable over <u>Kashyap</u> (USPN: 6,307,679) in view of <u>Inoue</u> (USPN: 4,792,197). This rejection is respectfully traversed.

<u>Kashyap</u> teaches a method for making an apodized Bragg grating in an optical fiber. In <u>Kashyap</u>, a first set of interference is formed by means of two light beams 4 and 3a from the same laser and a second set of interferences is formed by means of a beam 4 and another beam 3b. This beam 3b is obtained by placing a transparent corner 15 in beam 3a.

<u>Inoue</u> teaches a method for making Bragg gratings using two light beams from the same laser 11. These two beams interfere on a sample 15 by means of two mirrors 141 and 142. A transparent plate 24 is placed on the path of one of the two beams. A single portion 24' of this plate 24 is covered with a layer 25. This makes it possible to obtain a phase shift between two portions of one of the beams.

However, <u>Inoue</u> does not teach or suggest the process as claimed in claims 13-16 of the present application because Inoue teaches a method involving the transferring of an interference pattern into a substrate by creating the interference pattern and chemically etching the substrate. See Col. 1, lines 61 to col. 2, line 23. In contrast, in the presently claimed invention, the interference pattern is directly written into the transparent substrate.

In addition, the teachings of <u>Kashyap</u> and <u>Inoue</u> cannot be combined because <u>Kashyap</u> uses a wedge for varying a wavelength in a continuous manner whereas <u>Inoue</u> uses a phase plate for varying a phase in a discontinuous manner. Besides, the modeling

of Kashyap device and Inoue device are completely different so that, even if a combination of these two citations could be imagined, the modeling of the corresponding device could not be carried out and such a device could not be made.

Even if the teachings of Kashyap and Inoue were to be combined in the manner proposed, the proposed combination would not possess all of the claim limitations of claims 16-18, and 20. Claims 16-18, and 20 would still have novel and unobvious limitations over the proposed modification. For example, a combination of Kashyap and Inoue does not teach the use of a **phase plate having an adjustable position and orientation** as claimed in the present Application. See claim 13. The Office Action also admits that the cited reference does not teach about the **means for adjusting the position of the phase plate**. See claim 17.

Thus, Applicant submits that claims 16-18, and 20 recite novel subject matter which distinguishes over any possible combination of Kashyap and Inoue. In view of the foregoing, it is respectfully asserted that claims 16-18, and 20 are now in condition for allowance.

Rejection under 35 USC §103(a) – claim 19

Claim 19 stands rejected under 35 USC 103(a) as being allegedly unpatentable over Kashyap (USPN: 6,307,679) and Inoue (USPN: 4,792,197) and further in view of Cook (USPN:5,629,998). This rejection is respectfully traversed.

Cook teaches a method for forming a refractive index grating in a waveguide using a mirror.

Even if the teachings of Kashyap, Inoue and Cook were to be combined in the manner proposed, the proposed combination would not possess all of the claim limitations of claim 19. Claim 19 would still have novel and unobvious limitations over the proposed modification. For example, a combination of Kashyap and Inoue does not teach the use of a **phase plate having an adjustable position and orientation** as claimed in the present Application. See claim 13. The Office Action also admits that the cited reference does not teach about the **means for adjusting the position of the phase plate**. See claim 17.

Thus, Applicant submits that claim 19 recites novel subject matter which distinguishes over any possible combination of Kashyap, Inoue and Cook. In view of the foregoing, it is respectfully asserted that claim 19 is now in condition for allowance.

Rejection under 35 USC §103(a) – claim 22

Claim 22 stands rejected under 35 USC 103(a) as being allegedly unpatentable over Kashyap (USPN: 6,307,679) in view of Brueck (USPN:5,617,499). This rejection is respectfully traversed.

Brueck teaches a method of fabricating an electrooptically active fiber-segment using a "D" fiber where one side of the classing has been removed close to the core.

Even if the teachings of Kashyap and Brueck were to be combined in the manner proposed, the proposed combination would not possess all of the claim limitations of claim 22. Claim 22 would still have novel and unobvious limitations over the proposed modification. For example, a combination of Kashyap and Brueck does not teach the use of a **phase plate having an adjustable position and orientation** as claimed in the

present Application. See claim 13. The Office Action also admits that the cited reference does not teach about the **means for adjusting the position f the phase plate**. See claim 17.

Thus, Applicant submits that claim 22 recites novel subject matter which distinguishes over any possible combination of Kashyap and Brueck. In view of the foregoing, it is respectfully asserted that claim 22 is now in condition for allowance.

Rejection under 35 USC §103(a) – claim 24

Claim 24 stands rejected under 35 USC 103(a) as being allegedly unpatentable over Kashyap (USPN: 6,307,679) in view of Inoue (USPN: 4,792,197). This rejection is respectfully traversed.

With respect to dependent claim 24 which depend from claim 23 which depend from claim 13, the arguments set forth above are equally applicable here. The base claims being allowable, the dependent claim must also be allowable.

Thus, Applicant submits that claim 24 recites novel subject matter which distinguishes over any possible combination of Kashyap and Inoue. In view of the foregoing, it is respectfully asserted that claim 24 is now in condition for allowance.

Conclusion

For all of the above reasons, applicant submits that the amended claims are now in proper form, and that the amended claims all define patentability over the reference. Therefore, Applicant submits that this application is now in condition for allowance.

Request for allowance

It is believed that this Amendment places the above-identified patent application into condition for allowance. Early favorable consideration of this Amendment is earnestly solicited. If, in the opinion of the Examiner, an interview would expedite the prosecution of this application, the Examiner is invited to call the undersigned attorney at the number indicated below.

Respectfully submitted,
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Dated: August 12, 2002

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Abstract:

The abstract has been amended as follows:

--[Process for writing Bragg gratings, apparatus for using this process and Bragg grating devices obtained by this process.

According to the invention, a Bragg grating is written in a light guide (36) by transferring the interference pattern between two light beams (28, 30) with the same wavelength and coherent with each other but with an angular offset, directly into the substrate due to a photosensitivity phonomemon within the same said substrate, this interference pattern being transferred in the substrate in the form of a modulation of the refraction index of this substrate. At least one of the said light beams is divided into at least two sub-beams offset in phase with respect to each other.

Figure 10.] A light guide writes a Bragg grating in a transparent substrate by transferring the interference pattern between two light beams with the same wavelength and coherent with each other but with an angular offset. The interference pattern is transferred directly in the substrate in the form of a modulation of the refraction index of this substrate. At least one of the light beams is divided into at least two sub-beams offset in phase with respect to each other. --

In the Specification:

Paragraph beginning at page 4, line 12 has been amended as follows:

The invention also applies to an apparatus for use of the process according to the invention, this apparatus being characterized in that it comprises:

- at least one phase [splitter] plate capable of creating a phase shift between at least two sub-beams, due to a difference in the optical path, and
- a means of adjusting the position of the phase [splitter] plate, this adjustment means having at least two degrees of freedom, one being angular degree of freedom provided for adjustment of the value of the phase shift, and the other being a translation degree of freedom provided for adjustment of the position of the phase shift in the light beam formed by the two sub-beams.

Paragraph beginning at page 6, line 8 has been amended as follows:

This invention will be better understood after reading the following example embodiments given for information only and in no way restrictive, with reference to the attached drawings in which:

- Figure 1, described above, describes transmission variations in a conventional Bragg grating as a function of the wavelength,
- Figure 2 diagrammatically illustrates the interference diagram for two plane waves with no phase [splitter] plate,
- Figure 3 diagrammatically illustrates the interference diagram for two plane waves in the presence of a phase [splitter] plate,
- Figure 4 diagrammatically illustrates phase splitters placed in series,
- Figure 5 diagrammatically illustrates a curved phase [splitter] plate,
- Figure 6 diagrammatically illustrates a phase splitter formed by a lens,
- Figure 7 diagrammatically illustrates a phase splitter with an index change,
- Figure 8 diagrammatically illustrates a phase splitter inclined with respect to an incident light beam,
- Figure 9 diagrammatically illustrates a support device for a phase [splitter] plate that could be used in the invention,
- Figure 10 diagrammatically illustrates an amplitude separation writing process for a phase skip Bragg grating according to the invention, for an assembly with transverse irradiation,
- Figure 11 diagrammatically illustrates a wave front separation writing process for a phase skip Bragg grating according to the invention, using the prism method,
- Figure 12 diagrammatically illustrates another wave front separation writing process for a phase skip Bragg grating according to the invention, using a Lloyd mirror,
- Figure 13 shows variations in the transmission of a phase skip Bragg grating as a function of the wavelength,
- Figure 14 diagrammatically illustrates a partial double reflection in a Bragg grating around a phase change due to a cavity.
- Figure 15 diagrammatically illustrates propagative and counter-propagative coupling in a phase skip Bragg grating,
- Figure 16 diagrammatically illustrates an example of an index modulation with linear envelope, and
- Figure 17 diagrammatically illustrates an example of an index modulation apodized by a Gaussian curve.

Paragraph beginning at page 8, line 2 has been amended as follows:

According to this invention, interference is generated with one or a plurality of phase shifts by means of one or a plurality of optical phase shifting elements or phase [splitters] plate.

The first step (Figure 2) is the simple case of two plane light waves O_1 and O_2, output from the same light beam and with no phase [splitter] plate. The electrical fields for these two waves are denoted $\vec{E}_1 and \vec{E}_2$, the corresponding wave planes are denoted P_1 and P_2 and the corresponding wave vectors are denoted $\vec{k}_1 and \vec{k}_2$. The modulus of

$\vec{k}_1 and \vec{k}_2$ is denoted k, and the modulus of $\vec{E}_1 and \vec{E}_2$ is denoted ξ_o. The intensity I (z) resulting from the interference of these two waves on the Oz axis in Figure 2 is therefore in the form:

Paragraph beginning at page 9, line 3 has been amended as follows:

The zones I and II corresponding to two parallel sub-beams formed by the wave O_2 after it has passed through the [splitter] plate 2, which is thicker in the part facing area II than in the part facing area I. The intensity I (z) then becomes:

Paragraph beginning at page 9, line 15 has been amended as follows:

On Oz, the phase change abscissa is determined by the relative position of the splitter 2 with respect to beam O2. Therefore, this abscissa z_t can be modified very easily by the [splitter] plate translating along a y axis parallel to this [splitter] plate. It can be seen that the interference area is delimited by the abscissas O and z_f on the Oz axis.

Paragraph beginning at page 9, line 22 has been amended as follows:

The value $\Delta\Phi$ is determined by the difference in optical path in the [splitter] plate between areas I and II. This [splitter] plate can be made such that $\Delta\Phi = \pi$. Furthermore, this value can be modified very simply by rotating the [splitter] plate at an angle Θ to incline this splitter with respect to beam O_2.

Paragraph beginning at page 9, line 28 has been amended as follows:

According to the invention, two waves with multiple phase changes can also be made to interfere; in the same way as a phase [splitter] plate comprising a step induces a phase shift in the interference pattern as shown in Figure 3, a series of [splitters] plates 4, 6, 8 placed in sequence can be placed in one O3 of the two interfering beams (for example ultraviolet beams) (Figure 4). The result is then an interference pattern with a series of phase changes corresponding to steps 10, 12, 14 in splitters 4, 6, 8 respectively.

Paragraph beginning at page 10, line 2 has been amended as follows:

Another solution is to combine this series of [splitters] plates into a single [splitter] plate that induces a series of phase shifts by multiple changes in the optical path (stepped splitter).

Paragraph beginning at page 10, line 12 has been amended as follows:

We will now explain the production of a phase [splitter] <u>plate</u>. The material from which is [splitter] <u>plate</u> is made must be transparent to the wavelength(s) that will be used to write the Bragg grating by photosensitivity in a light guide.

Paragraph beginning at page 10, line 17 has been amended as follows:

In the following, the production of a single phase change [splitter] <u>plate</u> is described, but [splitters] <u>plates</u> with several phase changes could be made in a similar manner.

Paragraph beginning at page 10, line 21 has been amended as follows:

The [splitter] <u>plate</u>, or the element creating the optical phase shift that is the easiest to make and the most practical to use has a parallelepiped shape. When this type of [splitter] <u>plate</u> is inserted in a beam, the input wave front also appears at the output, but there are one or several additional phase shifts due to at least two different optical paths (Figure 3).

Paragraph beginning at page 10, line 28 has been amended as follows:

For some applications of the invention, it may be necessary to use a non-parallelepiped shaped [splitter] <u>plate</u> in order to adapt the configuration of this [splitter] <u>plate</u> to the wave front of the beam for which the phase is to be shifted. For example, it may be necessary to make a phase change without changing the propagation characteristics of a non-parallel beam in which the [splitter] <u>plate</u> is inserted; for example (Figure 5) a [splitter] <u>plate</u> 9 delimited by two coaxial cylindrical faces 11 and 13 can be made; due to the optical path transition symbolized by line 15, a [splitter] <u>plate</u> of this type placed in a beam that converges o the axis common to the faces, induces a phase shift on the beam as shown in the example in Figure 3.

Paragraph beginning at page 11, line 11 has been amended as follows:

A phase change may also be necessary with a change in the beam propagation characteristics. For example, this could be done using a lens that could be considered as a non-parallelepiped shaped [splitter] <u>plate</u>. The phase change is then inserted using the same principle as above. A cylindrical lens 16 can be seen in the example in Figure 6, that focuses a beam while applying a phase skip to it due to the transition of the optical path symbolized by line 17.

Paragraph beginning at page 11, line 20 has been amended as follows:

The phase skip I the [splitter] plate can be obtained by changing its thickness. This can be done by etching one or several parts of the [splitter] plate or by depositing one or several layers on one or several parts of the splitter. For example, considering a [splitter] plate with two areas with thicknesses e_1 and e_2 respectively, the wave front is deformed after passing through the [splitter] plate due to the phase shift $\Delta\Phi = (2\pi / \lambda)$ (n-1) (e_2 - e_1) where n is the index of the material from which the [splitter] plate is made and λ is the wavelength of the beam that passes through it.

Paragraph beginning at page 12, line 1 has been amended as follows:

Thus, a [splitter] plate with a thickness e2 can be used that is inserted in a certain beam thickness perpendicular to the wave planes of the beam (hence $e_1 = 0$).

Paragraph beginning at page 12, line 5 has been amended as follows:

The wave propagation index in one or several parts of the [splitter] plate can also be modified to induce one or several optical path changes and therefore one or several phase skips. For example, consider a [splitter] plate with thickness e and index n. If the index becomes n' for a thickness e' as shown in Figure 7, the result will be e' (n'-n) = (2k +1) λ / 2 (where k is an integer number). However, when the [splitter] plate is inclined (in order to adjust the phase shift), the two beams do not "see" the same index and therefore will be deviated differently. Therefore, a phase [splitter] plate with an index change at normal incidence should be used.

Paragraph beginning at page 12, line 17 has been amended as follows:

In the case of a [splitter] plate with a thickness change, different phase shift values can be obtained by changing the inclination angle Θ of the [splitter] plate with respect to the beam without inducing any angular separation. The inclination or rotation may be made about an axis A (Figure 8) parallel to the edges of the step that delimits the phase skip, or about an axis B perpendicular to the edges of the step and in a plane parallel to the two faces of the splitter.

Paragraph beginning at page 13, line 10 has been amended as follows:

Figure 9 shows a device 18 supporting a phase [splitter] plate 20 used to insert the phase [splitter] plate in a beam. This device comprises adjustment means that provide it with various degrees of freedom. The stacking order of these adjustment means is arbitrary. For the example shown, Figure 9 shows six adjustment means 19-1 to 19-6 corresponding to six degrees of freedom $\alpha, \beta, \theta, y, z$ and x (<<y>>, <<z>> being the translations along the y and z axes perpendicular to each other; <<x>> being the translation along the x axis perpendicular to each of the y and z axes; and

$<<\alpha>>, <<\beta>>$ *and* $<<\theta>>$ being the rotations about axes parallel to y, z and x respectively). However, the support device may have more or less degrees of freedom depending on the configuration of the splitter and the wave front of the incident beam, and depending on the interferometric setup in which it is to be inserted (for example z is not essential).

Paragraph beginning at page 14, line 1 has been amended as follows:

For example, a parallelepiped-shaped [splitter] plate can be adjusted based on five degrees of freedom:

- α and β to keep the material change edges 22 vertical, that can also be achieved by construction,
- x to position the [splitter] plate in the beam,
- θ to adjust the phase shift value,
- y to adjust the position of the phase skip in the Bragg grating.

Paragraph beginning at page 14, line 17 has been amended as follows:

In the following examples, different configurations of interference setups are shown with the insertion of a phase [splitter] plate device in order to introduce a single phase change in a Bragg grating. Two writing configurations of a Bragg grating are considered. The first is an amplitude separation configuration in which the two beams are separated for energy but keep the same shape. The second is a wave front separation configuration.

Paragraph beginning at page 15, line 1 has been amended as follows:

The second setup corresponds to a setup with three mirrors (see document (1)). In both cases, a separating [splitter] plate 24 (Figure 10) divides a light beam 26 into two identical beams 28 and 30. An interferometric system with two or three mirrors (two mirrors 32 and 34 in the example in Figure 10) superposes these two beams 28 and 30 that for a given angle ψ, at the fiber 36. The interferences thus created write the grating in the fiber by cylindrical focusing lenses 38 and 40. The phase [splitter] plate 42 needs to be placed in one of the two interfering beams.

Paragraph beginning at page 15, line 12 has been amended as follows:

In general, the disadvantage of the amplitude separation setup is due to the fact that the phase splitter has to be adjusted each time that the Bragg wavelength is modified since the orientation of the insolation beam is modified. In order to overcome this disadvantage, the [splitter] plate support device (not shown) must be controlled along degrees of freedom y and θ

(see above) by a program that takes account of the setup beam movements necessary for adjustment of the Bragg wavelength.

Paragraph beginning at page 15, line 22 has been amended as follows:

We will now consider wave front separation configurations, and firstly an interferometric setup with a prism. Note that the method of separating the wave front has the advantage that the phase [splitter] <u>plate</u> can be placed immediately after the beam expansion system before the wave front separation. An important advantage of this configuration is that the phase shift can be adjusted by rotating the splitter independently of the Bragg wavelength adjustment that is obtained by rotating the interferometric system.

Paragraph beginning at page 16, line 1 has been amended as follows:

The prism writing method (see document (8)) is diagrammatically illustrated in Figure 11 in which an extended beam 44 is "folded on itself" by reflection on a face of the prism 46. In Figure 11, the reference 48 shows a cylindrical lens. It can be seen that the determination of the Bragg wavelength fixed by the inclination of the two interfering beams, can be adjusted by rotating the prism, against which the fiber 36 is placed. If this rotation is made about an axis perpendicular to the plane of the Figure and passing through the phase skip projected in the optical fiber, then the phase [splitter] <u>plate</u> 42 placed on the trajectory of the beam 44 in front of lens 48, does not need to be adjusted for the different prism positions.

Paragraph beginning at page 17, line 30 has been amended as follows:

The distribution of intensity in the plane of the CCD camera is characteristic of the envelope of the intensity distribution of the two half parts of the beam on the focusing line at the Lloyd mirror. Provided that the Fresnel diffraction effect between the grating and the camera can be corrected, this distribution can be used to determine the envelope of the beam intensity generating the Bragg grating. This setup property is used to adjust the position in the grating of the phase skip(s) (using the y degree of freedom), with optimum control due to the diffraction pattern generated by edge effects related to each thickness change in the phase [splitter] <u>plate</u>. When this adjustment has been made, the laser beam is focused in the optical fiber and writing the required Bragg grating can begin.

Paragraph beginning at page 25, line 3 has been amended as follows:

5. Production cost: the cost of the apparatus is not very high since it is not expensive to manufacture a phase [splitter] <u>plate</u> by deposition, and it is relatively easy to

install it on a moving plate. Since the apparatus is also capable of writing all possible wavelengths, it can also be considered as being very cost effective. It is also economically attractive since it ca be used to make other components.

Paragraph beginning at page 25, line 22 has been amended as follows:

If several phase [splitters] plates are placed in the path of the beam, Bragg grating with multiple phase skips can be written, the advantage of which has already been described (see document (13)).

Paragraph beginning at page 27, line 17 has been amended as follows:

The invention solves this problem in a very simple and inexpensive manner. The phase [splitter] plate is placed in the beam using the device with several degrees of freedom. The position of the phase skip is outside the grating such that the phase in the grating is constant. The grating is then written in the same way as if there had been no [splitter] plate. If the decision is made to erase the grating, then the device is ordered to translate the splitter to create a phase change of π over the entire grating. For example, for a Lloyd mirror grating, this is equivalent to placing the phase skip on the optical axis of the beam, to shift the two interfering parts out of phase by π. This then prolongs writing until the grating spectrum disappears.

Paragraph beginning at page 34, line 1 has been amended as follows:

The first two test gratings can be erased using the method described above. We can now write the Fabry-Perot cavity grating. The phase skip is placed at a distance l_1 from the edge of the grating using an apparatus conform with the invention, a grating is written for a time t_1, and the [splitter] plate is then moved by translation using its support device over a distance e, and writing is prolonged by a time t_2. The Fabry-Perot cavity Bragg grating is written.

Paragraph beginning at page 40, line 23 has been amended as follows:

2. Ease of use: it is easy to produce the grating. All that is necessary is to measure the growth function of a grating at a given power, and then to invert the function A (z) to b e produced. Each [splitter] plate support device, with its control software installed on it, then manages displacement of the corresponding splitter.

The equation in the specification on page 21, line 5 has been replaced as follows:

$$\frac{dA^+}{dz} = j\Omega A^- e^{-j[2\Delta\beta.z+\phi(z)]}$$

The equation in the specification on page 22, line 2 has been replaced as follows:

$$C_2 = \Delta\beta\gamma \sinh(\gamma L)$$

The equation in the specification on page 22, line 8 has been replaced as follows:

$$T = \frac{\gamma^4}{\Delta\beta^2(\Delta\beta^2 \cosh^2(\gamma L) + \gamma^2 \sinh^2(\gamma L) - 2\Omega^2(\cosh(\gamma L)) + \Omega^4)}$$

The equation in the specification on page 31, line 3 has been replaced as follows:
$\Delta n_0 / 2$

The equation in the specification on page 31, line 21 has been replaced as follows:

$$\Delta n(z) = \Delta n_1(z) + \Delta n_2(z) = \Delta n_{aver} - \Delta n_0 . \cos\left(\frac{2\pi}{\Lambda}.z\right)$$

The equation in the specification on page 42, line 9 has been replaced as follows:

$$z_n^2(t) = \frac{L}{2}\left[1 + \frac{2}{N}.\sqrt{\ln\left(\frac{T}{T-2.t}\right)}\right]$$

In the claims:

Please amend claims 13-24 as follows:

13. (Once Amended) [Process for writing a Bragg grating in a transparent substrate (36) forming a light guide, particularly in an optical fiber, the Bragg grating forming a spectral filter with regard to a light wave that passes through it, process according to which the interference pattern between two light beams (28, 30) with the same wavelength and coherent with each other but with angular offset, is transferred directly into the substrate due to a photosensitivity phenomenon within the same said substrate, this interference pattern being transferred in the substrate in the form of a modulation of the refraction

index of this substrate, this process being characterized in that a phase splitter with an adjustable position and orientation is used to divide at least one f the said light beams into at least two sub-beams, creating a phase shift between the two sub-beams and generating a corresponding phase shift in the Bragg network.] A process for writing a Bragg grating in a transparent substrate, the Bragg grating forming a spectral filter with regard to a light wave that passes through it, the process comprising:

generating an interference pattern between two light beams with the same wavelength and coherent with each other but with angular offset; and

writing said interference pattern to the substrate, in the form of a modulation of the refraction index of the transparent substrate, with a phase plate having an adjustable position and orientation,

wherein said phase plate divides at least one of said light beams into at least two sub-beams, creates a phase shift between said at least two sub-beams, and generates a corresponding phase shift in the Bragg grating.

14. (Once Amended) The process according to claim 13, wherein said writing further comprises using [in which the interference pattern is transferred according to] an amplitude separation configuration.

15. (Once Amended) The process according to claim 13, wherein said writing further comprises using [in which the interference pattern is transferred according to] a wave front separation configuration.

16. (Once Amended) <u>The</u> process according to claim 13, [in which] <u>wherein</u> the position of [the] <u>said</u> phase shift or the value of [this] <u>said</u> phase shift or the position and value of [this] <u>said</u> phase shift in the light beam formed by [the] <u>said at least</u> two sub-beams, [can be] <u>is</u> modified with time.

17. (Once Amended) <u>An</u> apparatus for [use of the writing process according to Claim 13, this apparatus being characterized in that it comprises] <u>writing a Bragg grating in a substrate, said apparatus comprising</u>:

[-]at least one phase <u>plate</u> [splitter (42)] capable of creating a phase shift between at least two sub-beams[, due to a difference in the optical path,]<u>;</u> and

[-a] means [(61) of] <u>for</u> adjusting the position of [the] <u>said</u> phase <u>plate</u> [splitter, this adjustment] <u>said</u> means <u>for adjusting</u> having at least two degrees of freedom, one being angular degree of freedom provided for adjustment of the value of the phase shift, and the other being a translation degree of freedom provided for adjustment of the position of the phase shift in the light beam formed by the two sub-beams.

18. (Once Amended) <u>An</u> apparatus according to claim 17[, also] <u>further</u> comprising interferometric means with two or three mirrors [(32, 34)] for transferring the interference pattern according to an amplitude separation configuration<u>, said interferometric means coupled to said means for adjusting</u>.

19. (Once Amended) <u>An</u> apparatus according to claim 17[, also] <u>further</u> comprising interferometric means with a prism [(46) or a Lloyd folded mirror (64)] for transferring

the interference pattern according to a wave front separation configuration, said interferometric means coupled to said means for adjusting.

20. (Once Amended) The [Phase skip Bragg grating with high spectral selectivity obtained by the] process according to claim 13, wherein the phase shift between [the] said at least two sub-beams is substantially [advantageously being] equal to π.

21. (Once Amended) The [Bragg grating obtained by the] process according to claim 13, further comprising:

writing said interference pattern in the substrate with a phase plate, wherein the substrate includes a pre-written identical [this] Bragg grating [being identical to a pre-written Bragg grating and being written on this pre-written grating], at the same position, with a phase change of over the entire length of the prewritten grating, to erase all or some of the pre-written [original] grating in order to obtain a given reflection coefficient.

22. (Once Amended) The process according to claim 13 further comprising:

forming a Fabry-Perot cavity delimited by two Bragg gratings at different positions in space[, these two Bragg gratings being obtained by the process according to Claim 13].

23. (Once Amended) The process according to claim 13 further comprising:

forming a Bragg grating with a determined index modulation envelope[, particularly an apodized Bragg grating, obtained by the process according to Claim 13,]

by successively writing two Bragg gratings comprising parts in phase opposition, the time taken to overwrite one Bragg grating by the other being variable, [to give a variable] the position of the phase shift being variable and [a variable] the value of the phase shift being variable.

24. (Once Amended) The process according to claim 23, wherein [Bragg grating according to Claim 23,] the position of the phase shift is being displaced by a programmable movement.

25. (New) The process according to claim 13, wherein said light guide is an optical fiber.

26. (New) The process according to claim 23, wherein the Bragg grading is an apodized Bragg grading.

27. (New) An apparatus according to claim 17 further comprising interferometric means with a Lloyd folded mirror for transferring the interference pattern according to a wave front separation configuration.